Light and Lighting

Vol. XLI.—No. 5 May, 1948 Price: One Shilling

Reproduced by courtesy of the Victoria and Albert Museum.

A Backward Glance

Not only has the appearance of ships changed almost beyond recognition in a hundred years, as this drawing of the Pool of London in the 1840's indicates, but electrical developments have brought about equally dramatic improvements in lighting and navigation.

Like many of the things which make life so much easier for us today, electric lighting is often taken for granted, little thought being given to the ceaseless research which goes towards its further improvement. The history of the modern electric lamp is a record of the progressive co-operation of Members of the Electric Lamp Manufacturers' Association. By pooling their resources and working for a common end they have provided the people of this country with lamps of a quality unsurpassed anywhere in the world.

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I.E.S. Annual Report

THE Report of the I.E.S. Council for the past year, now available, contains evidence of substantial progress. Nearly 300 new members were secured. New groups have been formed in Brighton and Exeter. The total meetings held, 134, must be a record. Other developments include the Register of Lighting Engineers (now in actual operation), special publications and plans for education in Illuminating Engineering.

All this has naturally involved greater expenditure. Fortunately, income has kept step and there is a small but satisfactory balance (about 5 per cent on the total annual income) on the right side—thus complying with the famous injunction of Mr. Micawber.

Illumination Notes and News

A Symposium on Searchlights

It will be recalled that, at a very successful I.E.S. meeting held in London on April 15, 1947, a series of five papers dealing with various aspects of the design, function and use of searchlights was presented. Amongst the topics discussed were army searchlights, high power searchlights capable of wide divergence, the photometry of searchlights, and visibility problems in naval and anti-aircraft work. To these have been added a sixth paper dealing with aircraft searchlights in submarine work.

The whole series is now about to be published as a special book of limited edition which will probably be on sale by the time this notice appears. The book comprises 164 pages with 116 diagrams and illustrations and contains a wealth of hitherto unpublished information on work carried out in this field during recent years. The issue of this interesting symposium is a new departure on behalf of the I.E.S. There is no doubt that it will prove of great interest, not only to its members but to many outside its ranks concerned with searchlights and their use.

Copies (price 17s. 6d.; by post 18s. 6d.) will be obtainable on application to the Secretary of the Illuminating Engineering Society, 32, Victoria-street, London, S.W.1.

E.L.M.A. Illumination Design Courses

The 52nd Illumination Design Course, which took place during April 27—30, provided about 15 lectures on general topics and was in great demand. It is to be followed during May 25—27 by a special three-day Continuation Course, the lectures in this case being of a somewhat less general and more specific nature. This course is open to all who have attended the 52nd Illumination Design Course. Special consideration is, nevertheless, being paid to the needs of those who have been unable to attend any of the previous course and yet feel that the continuation course would be helpful.

I.E.S. Summer Meeting

As the membership of the I.E.S. includes a number of amateur photographers, *Light and Lighting* has decided to offer a prize of two guineas for the best photograph taken by an I.E.S. member at the forthcoming Summer Meeting and published in the journal. Prints submitted for reproduction must not be creased, and must bear the name and address of the member on the reverse. Entries should be sent to the Editor, *Light and Lighting*, 32, Victoria-street, to reach him not later than June 30. Prints should be not less than 2½ inches square, larger sizes being more suitable for reproduction.

Award to Sir Clifford Paterson

According to *Illuminating Engineering* (March, 1948), Sir Clifford C. Paterson, well known through his position as director of G.E.C. Research Laboratories and as the earner of many high distinctions, is to be awarded the Gold Medal granted annually by the American I.E.S. for meritorious achievement. The decision, it is stated, was attained after careful study of the records of eight candidates. This recognition by our friends in the United States of the work of one of our own Past Presidents will be noted with pleasure by all I.E.S. members in this country.

Lectures to School Children

Much attention is now being devoted by the I.E.S. to this question and excellent work has been done recently by some of the Centres. A case in point is furnished by the Cardiff Centre by whom a series of lectures (by Mr. D. C. James, Mr. W. Cooper, Mr. N. D. Houston and Mr. H. L. Tredree) was recently arranged in Newport (Mon.). The Assembly Room at the Town Hall was placed at the disposal of the Society for five days and over 1,100 children, boys and girls of ages from 13 to 17, attended. Once more every possible assistance was given by the Education Authorities who made all necessary arrangements with local schools and organised the transport.

The series was formally opened by the Mayor, who was supported by the Deputy Mayor, the Director of Education, the Chairman of the Education Committee, and the Borough Electrical Engineer, all of whom were guests of the Society at an informal luncheon.

Presidential Visit to I.E.S. Leeds Centre

The I.E.S. President, Dr. J. W. T. Walsh, visited the I.E.S. Leeds Centre on April 5 when, following the annual general meeting, he delivered his address which dealt mainly with the training of Lighting Engineers. Dr. Walsh took the unusual, but in this case advantageous, step of inviting comment on the address. In the discussion a number of practical points were raised, several speakers emphasising the need for knowledge of installation work and building design. In reply to comments by Dr. Walton, who referred to the difficulties of those unable to attend courses at colleges or large centres, Dr. Walsh mentioned that several correspondence schools were now running courses in illuminating engineering—though naturally this was a second best as compared with attendance at regular courses at technical colleges.

Retirement of Mr. H. A. Lingard

The retirement of Mr. H. A. Lingard, which has recently been announced, brings to an end a long period of service with the British Thomson-Houston Co., Ltd. Mr. Lingard entered the service of the company in 1904; after filling various positions, he became, in 1928, general manager of the Lamps and Lighting Department and, three years later, a director.

In addition he has served on a number of bodies interested in lighting, being several times chairman of E.L.M.A. He is a member of the I.E.S. of long standing, and at the present time a member of the Council.

Papers, Please!

At this season of the year it is customary to remind I.E.S. members that programmes for the forthcoming session are in preparation and that offers of papers would be welcome. *Offers* of papers, in addition to those sought for by diligent officers of the Society, are much to be desired. We hope, therefore, that this note will catch the eye of some of those with material to offer and that they will be quick to respond. It is curious that those with special information at their fingers' ends often quite fail to realise that what they know so well themselves may be interesting to others. There should be more papers from members who are not associated with lighting firms, but act as lighting engineers to industrial concerns, and who have therefore a special viewpoint besides knowledge of conditions in practice. A case in point is furnished by the interesting paper on "Lighting Problems in a Sugar Refinery" recently given by Mr. F. W. White to the I.E.S. Liverpool Centre, a summary of which appears on p. 101. There must surely be many other members whose work brings them in contact with special problems such as this. We appeal to them to come forward and "tell the world."

Analysis by Fluorescence

In a recent issue of the Osram "Bulletin" an account is given of the use of the 125-w. "black glass" ultra violet lamp to excite fluorescence and thus to test inks, dyes, and foodstuffs, the authenticity of documents, and for many forms of adulteration. For example, the mixture of margarine with butter is readily detected, decomposition in fish can be identified in early stages, and repairs of concealed blemishes in rare postage stamps (e.g., "triangular Capes") revealed. The apparatus with which such tests can be made is now relatively simple and it seems to offer a fascinating field for research. Fluorescence may well serve as a delicate means of analysis in many directions as yet unsuspected and unknown.

U.S.A. Lighting Handbook

We have referred several times to efforts being made to secure a consignment of the useful handbook issued by the American I.E.S. for the benefit of I.E.S. members in this country, a considerable number of whom have applied to headquarters for copies. We now learn that difficulties in regard to the transfer of dollars to the United States have been satisfactorily overcome and the money dispatched, and that members on the list furnished to our friends in America are now duly receiving their copies. It is satisfactory to note that this somewhat awkward problem has been solved, and our warm thanks are due to the American Society for their efforts in this connection.

The ultimate result, when the cost is divided amongst the members concerned, is that copies will cost 30s. each, which is considerably less than the published price in America or the price that could be obtained by members individually.

We are asked to take this opportunity of requesting all those members who have received their copies kindly to forward the above sum (30s.) to the Secretary of the I.E.S., 32, Victoria-street, London, S.W.1, in due course.

Testing Fluorescent Lamp Circuits

By W. A. R. STOYLE, B.Sc., A.M.I.E.E.

The following is an extract from a paper on this subject recently presented by the author to the Edinburgh Centre of the I.E.S. A further extract dealing with the servicing of fluorescent lamp installations will be given in a subsequent issue.

The satisfactory operation of a fluorescent lamp is dependent on the correct control gear being used so that the lamp is operated under the conditions for which it is designed. If the appropriate choke coil for the average mains voltage concerned is used, the lamp should be consuming a power very close to the rated lamp wattage. The consumption can be derived from the lamp voltage and current, the lamp wattage being obtained by multiplying the product of lamp volts and current by a form factor of approximately 0.9.

It is often difficult, however, to test the starting and running conditions of fluorescent lamps and control gear under normal working conditions unless the wiring is altered to enable the necessary meters to be connected. A simple adaptor has therefore been designed to enable these tests to be carried out without alteration to the wiring.

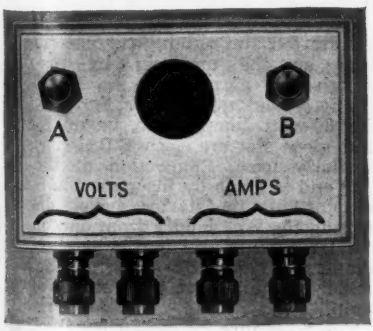

Fig. 1. Simple adaptor for testing the starting and running conditions of fluorescent lamps and control gear.

The adaptor (Fig. 1) consists of a switch block approximately 5½ in. x 3½ in., a canister socket, two press switches, and four insulated terminals. One of the press switches is normally

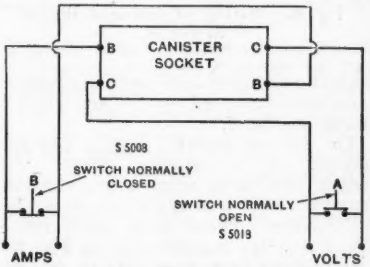

Fig. 2. Wiring of test adaptor shown in Fig. 1.

open-circuited and the other short-circuited in the "off" position. The wiring of these components is shown in Fig. 2.

Two sets of leads are required, one for use with fittings using canister type starters, and one for fittings made for use with the S.B.C. glow starters and lamps with bayonet caps. In the former case the lead, illustrated in Fig. 3, consists of two canister starters

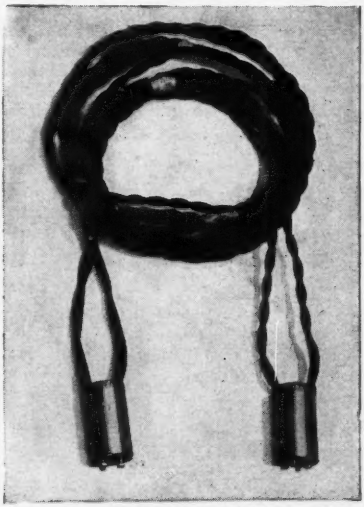

Fig. 3. Test-lead for fittings with canister-type starters.

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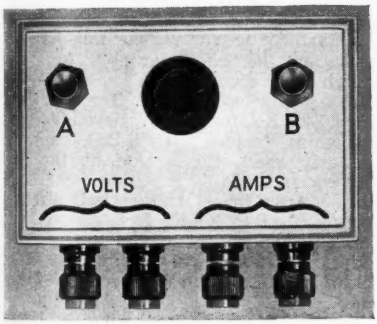

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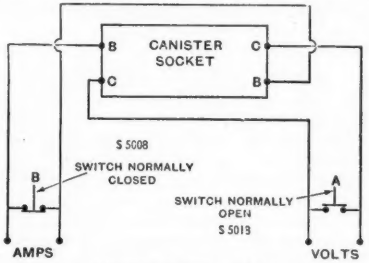

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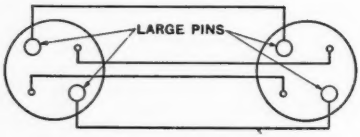


Fig. 4. Wiring of test-lead shown in Fig. 3.

with the switches and radio suppression capacitors removed, which are wired as shown in Fig. 4.

For testing 80-watt lamps the lead consists of a canister starter with switch and radio suppression capacitor removed, B.C. and S.B.C. adaptors and B.C. holder. These leads are shown in Fig. 5 and are connected as in Fig. 6.

It will be seen from Fig. 2 that the function of the press switch "A," which is normally open, is to short circuit the usual glow starter, and, when pressed and released after a few seconds, acts as a "manual" starter and strikes the lamp

The press button switch "B" is connected across the ammeter and is normally short circuited. It must, therefore, be depressed for current readings to be taken. Since this button switch is connected across the ammeter terminals it acts as a safety shunt to

Fig. 5. Test-lead for 80-w. lamps with bayonet caps and S.B.C. glow starters.

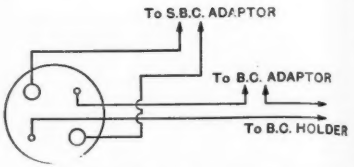


Fig. 6. Wiring of test-lead shown in Fig. 5.

the meter and also completes the circuit when the meter is not connected.

Using the Test Adaptor

To measure the operating characteristics of a 40-watt lamp the test canister at one end of the test lead is inserted into the socket on the adaptor panel, and the canister at the other end is inserted in the starter socket in the fitting, the normal starter, of course, being removed, and the lamp replaced in the fitting. The various readings are taken as follows:—

Mains Volts.—When the mains are first switched on to the fitting the voltmeter connected across the volt terminals on the test panel will register mains volts.

Lamp Volts.—If switch "A" is pressed and then released after about two seconds the lamp should strike, and the voltmeter will then register the voltage actually across the lamp.

Starting Current.—If switch "B" is pressed at the same time as switch "A," an ammeter connected between the amps. terminals on the test panel will register the lamp starting current.

Running Current.—When the lamp has started, the running current may be read on the ammeter by pressing switch "B" alone.

The second set of leads, for use with the 80-watt lamps with bayonet caps and glow starters with S.B.C. caps, is similarly used. Connection at the fitting end is made by inserting the S.B.C. adaptor into the starter socket, disconnecting the B.C. holder from one end of the lamp and inserting in it the B.C. adaptor, and finally placing the B.C. holder on the lead on the free end of the lamp.

The procedure for measuring the lamp characteristics is then the same as for the 40-watt lamp. As there are two ways of putting the test lead B.C. adaptor into

TABLE I

	80 watts	40 watts	
Lamp starting current (approx.)	1.3 amps.	0.7 amps.	Mains volts 200/250 with choke appropriate to the actual supply at the fitting.
Lamp running current (approx.)	0.85 amps.	0.41 amps.	
Lamp volts (approx.) ...	106	108	

the lamp holder on the fitting, it may be found that no running current is indicated. In this case the ammeter is actually connected on the starter side of the lamp instead of being connected on the mains side of the lamp. If this is found to be the case the B.C. adaptor must be reversed to obtain a current reading.

All these measurements can, of course, be carried out by a single universal volt-ampere meter, but in this case the meter leads have to be changed over from the volt terminals to the ampere terminals on the adaptor test panel to enable the various readings to be taken.

A complete testing unit, incorporating meters, test leads, and control switches, working on the principles described above, can be constructed quite easily.

The approximate lamp operating characteristics for 40-watt and 80-watt lamps are given in Table 1. It must be remembered that the lamp takes a few minutes to achieve complete stability, particularly if the ambient temperature is low. Table 1 refers to inductively controlled circuits. Where the lamp is capacitatively controlled, the lamp starting current is materially the same as the lamp running current. The power factor of an uncorrected lamp circuit due to the inductance of the choke coil, is approximately 0.5, and the lamp and mains current will be as quoted in Table 1. When the power factor is corrected by means of the recommended capacitor, the lamp current will, of course, be unaltered, but the mains current will be reduced.

In cases where the lamp attempts to strike, but will not remain alight, it is helpful to know the operating conditions, as the fault may be due to (1) low mains voltage, (2) correct mains voltage but abnormally low lamp current due to incorrect gear, (3) starter switch, or (4) the lamp itself. (1), (2), and (3) may be checked by the method described above.

In the case of a fitting in which the lamp has failed because of the passage of excessive current, it would be inadvisable to install a new lamp before checking the circuit conditions. This can be done conveniently with the testing unit by short-circuiting the two lamp holders in the fitting concerned, and measuring (a) the short-circuit current of the choke coil; (b) the voltage across the starting switch.

In the former case the current should not exceed about 0.8 amperes in the case of a 40-watt lamp, and about 1.6 amperes for an 80-watt lamp. If these figures are materially exceeded, or the circuit fuse blown, there is probably some fault in the choke coil or an earth fault in the wiring. If the voltage across the starting switch is in excess of the mains voltage, the power factor capacitor is connected across the lamp and not across the mains, thus forming a partially series resonant circuit with destructive effect on the lamp.

Convenient adaptors for short-circuiting the lamp holders can be made from (a) B.C. adaptors for use with the 80-watt lamp, or (b) two bi-pin caps short-circuited between pins and mounted as in Fig. 7 for the 40-watt lamp.

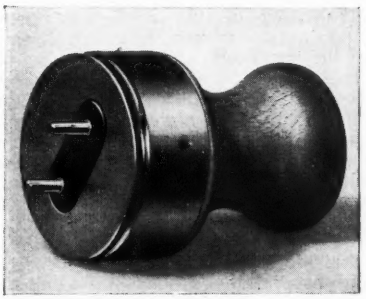


Fig. 7. Adaptor for short-circuiting lamp holders.

Lighting Progress

Notes on the Report of the Committee on Progress of the American I.E.S. (*Illum. Engineering*, Dec. 1947, p.955).

Some years ago the question was asked in the United States: "What is wrong with our 50 ft.c. installations?" At that time such installations were still unusual. It was found (as is now illustrated in our own I.E.S. Code recommendations in regard to glare) that contrasts tolerable at low or moderate illuminations are no longer so when relatively high illuminations are reached.

Nowadays, it is reported, offices, classrooms and workrooms are quite commonly lighted at 50 to 100 ft.c. Apparently difficulties as regards excessive contrast in rooms so lighted have been substantially overcome. There is, however, an appreciable shock in stepping from such rooms into corridors or ante-rooms where 3 to 5 ft.c. may be furnished (or vice versa).

A new stage, as regards contrast, is reached when still higher levels of illumination are adopted. The report mentions a special case when an illumination of 230 ft.c. was actually provided. It was then found that contrasts which would be acceptable under 20-40 ft.c. became quite disturbing. It was accordingly found necessary not only to resurface the desk tops, but also desk bodies, cabinets, bookcases, box files and even waste paper baskets. Photographs are presented illustrating the diminished contrast and greater ease of vision thus secured.

In view of the continual rise in illumination values, and also because of the trend towards fluorescent lighting the feasibility of doubling branch circuit potentials from 120 to 240 volts is being suggested. The higher voltage would double the wiring capacity of many buildings sadly in need of it and might also lead to simplification in the accessories of fluorescent units.

Examples of fluorescent lighting are quoted. One of these was in the Royal Train in South Africa. The street lighting installations in Bond Street and elsewhere are also singled out for comment.

Special equipment with fluorescent units in printing works (where the difficulty is to furnish a system which illuminates the parts of intricate machinery) are illustrated. Allusion is made to the problem of securing illuminations of the order of 50 ft.c. in large industrial bays with a height of 70 ft. In one such case a combination of filament and mercury vapour lamps was adopted, approximately 10 watts per sq. ft. of floor area being used.

In America, as in this country, mischievous destruction of glass globes used with street lamps has been a great trouble. In Chicago nearly 10,000 broken panels a year are reported. Efforts to substitute plastic materials, much less easily broken, are being made. In one city 177 lanterns equipped with such panels are being tried out. Combinations of glass and plastic material are also being evolved for interior lighting, more especially fluorescent units.

Several new types of high intensity approach lights for aerodromes are described. A new advertising device takes the form of luminous messages outlined in the sky. For one display, mounted on a dirigible, 11,500 5-watt incandescent lamps are used. Experiments on the effect of aritficial light in horticulture are being made. In some cases quite a moderate illumination—as low as 1 ft.c. may be of service, the time at which it is applied (e.g., near midnight) being of great importance. On the other hand in one set of experiments an illumination as high as 2,200 ft.c. is mentioned.

The report mentioned a number of special inventions and devices. Of interest are the small fluorescent lamps —6 and 8 watt.—for domestic lighting. A new powder for application to fluorescent black light lamps is stated to increase the intensity in the fluorescing region 2½ times. There is also mention of a new fluorescent lamp requiring no starter switch or ballast, in the ordinary sense, owing to the use of a radio-active pre-ionising coating on the inside of the glass. Such lamps are intended for use direct on a line potential of 230 volts.

It is interesting to observe that the "sealed beam" principle, hitherto applied to motor-car headlights, is now being tested out for steam locomotives. A 30-volt. 200-watt lamp, yielding a central beam candle-power of 200,000 is adopted.

The Physical Society's Exhibition of Scientific Instruments and Apparatus

This, the thirty-second exhibition sponsored by the Physical Society, was held from April 6 to 9 at the Royal College of Science, South Kensington. The opening ceremony on the afternoon of the 9th was performed this year by the President of the Board of Trade, Mr. J. H. Wilson. The issue of tickets available only for a single session was again successful in preventing excessive overcrowding, so that, while the attendance was always very large, it was fairly evenly distributed, and at no time was it impossible to view the exhibits in reasonable comfort.

Trade Exhibits

There were a number of trade exhibits which had an interest for the illuminating engineer, some of them novelties developed during the past twelve months. On the lower ground floor Tintometer, Ltd., showed some new accessories for use with the Lovibond tintometer, particularly a cabinet for viewing samples by an artificial light closely resembling north sky light. They also exhibited a number of different types of fused cells, constructed in borosilicate glass, for containing coloured solutions. Unicam Instruments (Cambridge), Ltd., showed a photoelectric spectrophotometer in which a photocell of the rectifier type was used, while Messrs. Evans Electroselenium, Ltd., exhibited a very interesting range of rectifier photocells of different sizes and shapes. A composite cell, consisting of 16 small rectangular cells connected in series, gave, when strongly illuminated, up to 8 volts through an external resistance of two megohms. A portable illumination photometer was also shown.

On the mezzanine floor, Messrs. Leech (Rochester), Ltd., showed a number of lenses, mirrors and optical flats, including some rhodium-coated glass surfaces and some bloomed glass components. The exhibits of Adam Hilger, Ltd., were on this floor, and included a number of the high-grade optical instruments for which they are world famous. Among these may be mentioned a two-prism, large aperture spectrograph, a new model of the Hilger "Spekker" photoelectric absorptiometer and the "Uvispek" spectrophotometer for the ultra-violet and the visible spectrum.

Messrs. Chance Bros. and Austinlite, Ltd., were showing the new Chance OB9 glass, designed especially for photometric purposes, viz., for bridging the colour step between two sources, giving blackbody radiation at different colour temperatures. The glass gives a colour change of about 60 mireds per mm. thickness, i.e., a thickness of 1.6 mm., for example, changes a colour temperature of 2250 deg.K to one of 2860 deg.K. Another exhibit of interest to workers in photometry was the Chance neutral glass with better constancy of transmission through the spectrum. Densities from 0.17 to 1.5 per mm. are available.

The Mullard Wireless Service Company, Ltd., showed a number of flash tubes of different types and a group of caesium on silver oxide photocells sensitive in the red and infra-red parts of the spectrum. Another exhibitor of flash tubes was Dawe Instruments, Ltd., who showed a particularly neat and portable outfit for the photographer. This weighed only about 13 lb. The lamp unit operated the camera shutter by means of a mechanical trip, the flash being delayed long enough for the shutter to open.

Of particular interest to lighting engineers was Elliott Bros.' demonstration of a photoelectric controller for a lighting system such as street lighting. This made use of a rectifier photocell actuating a magnetic amplifier and mercury tube relay. Sangamo-Weston, Ltd., were showing a pocket-size photoelectric illuminometer, but there seemed to be no provision for correcting the readings to allow for the colour of the light. The Westinghouse Brake and Signal Company showed some rectifier photocells stated to give 550 microamperes per lumen of incident light. Two sizes are made, viz., 40 x 22 mm. and 35 x 19 mm. Among the publishers, Pitman's were showing the "Textbook of Illuminating Engineering," published last year, and a new publication,

Norden's "Shadow and Diffusion in Illuminating Engineering."

Research Exhibits

Most of the top floor was, as usual, devoted to exhibits from research and educational establishments, and these were well up to the usual standard for this section of the exhibition.

Siemens Lamp Research Laboratories had an interesting exhibit to demonstrate the way in which the spectrum given by an inert gas, actually krypton, changed with the current density of the discharge through it. They also showed some ribbon filament tungsten lamps required for such purposes as the standardisation of optical pyrometers.

The British Thomson-Houston Company's Laboratories showed the extent to which ultra-violet light of different wavelengths was transmitted through various types of glasses used for germicidal lighting equipment. The use of the compact source high-pressure mercury vapour lamp for high-speed kinematography was also demonstrated. It was interesting to notice, in passing, a Nernst filament being used as a particularly efficient source of infra-red radiation.

The Colour Group of the Physical Society had an extensive exhibit based on their recently issued Report on Colour Terminology. This showed where confusion was likely to arise due to the use of the same term with different meanings by different classes of colour users. Visitors were invited to record votes in favour of the terms they preferred for certain concepts, and the surprisingly large number of votes registered showed the extent of the interest now being manifested in the subject of colour.

The Building Research Station of the D.S.I.R. showed a model of a proposed design for the reconstruction of certain damaged galleries at the National Gallery. The main object was to illuminate the pictures on the walls of the gallery while leaving the central floor space with a much lower illumination. The basis of the design was a system of deep louvres between the outer roof and the glass of the laylight.

The Research Laboratories of the G.E.C. showed compact source discharge lamps with mercury-cadmium filling, developed for film studio lighting. A floodlighting unit, in which a lamp of this type could "simmer" until required, was demonstrated, and the fluorescent lighting equipment designed for use in mines was shown. The spectroscopist was interested to see the range of hot-cathode discharge lamps giving the arc spectra of sodium, cadmium, and mercury, extended by the addition of lamps containing thallium and krypton.

The exhibits of the Meteorological Office included a photoelectric visibility meter. This consisted of a small searchlight illuminating a photocell some 300 yards away. The photo-current provided a record of the transmission of the atmosphere between the searchlight and the cell. The Kodak Research Laboratories showed a servo-operated photoelectric densitometer, which gave an automatic indication of the density of any sample of either a neutral or a coloured material.

Discourses and Films

The discourses this year were not of special interest to the lighting engineer. The first, given by Dr. K. Mendelssohn, of the Clarendon Laboratory, Oxford, was on low-temperature physics, while on Wednesday Mr. H. L. Kirke, of the B.B.C., took as his subject "Studio Acoustics." The third discourse, on the reflecting telescope, was given by Dr. C. R. Burch, of Bristol University. On Friday, instead of a discourse, there was an additional showing of the film on atomic physics, dealing with the history and development of atomic energy. This film has been shown to large audiences each day throughout the exhibition. The other film, shown at intervals each day by the British Kinematograph Society, was entitled "Physics and the Film"; it showed how much the making of films depended upon physical knowledge and research.

The Physical Society and its officers, and all directly or indirectly responsible for the organisation of the exhibition, are to be congratulated on the excellence of the arrangements made. The facts that the descriptive catalogue of exhibits ran to 288 pages and that the number of individual exhibitors was 155 give some slight indication of the magnitude of the task which they undertook. The exhibition is undoubtedly of immense value not only to users of physical instruments and apparatus in this country but to visitors from overseas as well.

Lighting of Schools

The following is an abstract of a paper entitled 'An Architect Sees Lighting,' by Lawrence B. Perkins, a Chicago architect, which appeared in *Illuminating Engineering*, December, 1947.

Baking a cake and planning a school can hardly be called comparable undertakings. However, they have one need in common. Just as too much baking powder will ruin the most carefully concocted cake, too much of any one detail or requirement will unbalance a school, or at least its budget. Obviously, a school cannot be planned from a standard recipe, but by carefully considering *all* the requirements of an individual school as well as *all* information on school lighting, adding a pinch (or perhaps a handful) of common sense, the architect can better arrive at a specific solution for a specific school.

So much has been written on lighting, and lighting as it applies to schools, that it would be difficult to know which was the last word—and it would be even more difficult to know which was the best word. It is, however, the assignment of the architect to come as close to this as possible. We must choose from all these sources only those lighting theories and practices which will produce the best seeing conditions for each child in each classroom. This choice must have not only the approval of the lighting expert but it must also have the approval of the school treasurer.

Let us assume that School Board "X" is contemplating building a new school. Once upon a fine May morning they walk into the office of the architect of their choice and bare their plans and their hopes and their bonding power. All goes well at this first conference between Architect and Owner, but, as they are leaving, the President of the Board calls back—"and don't forget, we want the best possible job of lighting." The architect smiles them away and goes back to his notes on this meeting and this proposed school. They apparently have not forgotten a thing: eight classrooms, administration, skills rooms, cafeteria, music room, visual education, assembly room, lockers, furniture, heating, ventilation, and—oh yes!—the best possible job of lighting, *consistent with the whole school!*

The architect is concerned with the whole school. He not only has to light it, but he must heat it and ventilate it and consider all other amenities and keep them all in balance. We would not care to send our children to a school which had a wonderfully designed louvred ceiling, a ceiling so fine and so costly that there was no money left for a roof. Nor would we approve of a classroom with elaborate light fixtures and no furniture. Discretion must be applied.

The physics of light to-day has greatly liberated the school architect. When schools were in session during only daylight hours, and when the three "R's" constituted the bulk of the curriculum, daylight was the sole source of illumination. Daylight was then a controlling factor in the design of the school building: it not only defined the design of the school, it limited it. One expression of this limitation was based on rows of children in fixed furniture in fixed positions. This also limited the kind of teaching that could be carried out. To-day these limitations do not exist; however, daylight may control the design of a school built basically for younger children. When schools are used at all hours, during all seasons of the year, and are used by young and old alike, we must employ all liberating features in the design of the school which the physics of light has made available to us.

Today we know that the job of lighting in schools is much more than simply supplying enough light. There must also be a good quality of light, which means proper distribution, absence of glare, correct brightness control, and good environment control. This quality can be obtained only by using natural and artificial lighting in various amounts and proportions, sometimes, but not always, relegating natural light to a purely psychological position.

Think of the architectural implications of this lighting liberation! A classroom can be square or rectangular, with its short side the window side, and it reduces the height of the ceiling and produces a saving on construction costs

that can well take care of the costs of the lighting. It equips a school with the best possible lighting for 24 hours of a day, rain or shine, and it increases the value of the school to the whole community.

Factors which influence lighting in a school are both integral and applied. Some of the integral features apply to daylight controls, and include *orientation* which refers to the laying out of the building in relation to specific elements, suroundings and sun. *Window placement* is another "built-in" light feature. To-day we can plan windows not as holes in walls but as whole walls. At one time windows were permitted in only one wall of a classroom, but to-day we have advantageously used bilateral lighting, and now trilateral lighting comes to the fore. Bilateral lighting may be achieved with windows on adjacent sides of the room or with one long low window on one side of the room and a high clerestory opposite. The *window heads* should be continuous with the classroom ceiling. This reduces the horizontal dark band between the top of the windows and the ceiling. It increases the effective reflecting surface of the ceiling and this indirectly decreases the dark areas around the windows which cause brightness contrasts. *Low window sills* can't help but increase daylight intake, besides bringing the window down to the scale of the child. Fixed and movable *baffles* are integral daylight controls. Those outside the window are in the form of roof projections or overhangs, outriggers, venetian awnings and jalousies.

Some artificial lighting controls are also integral. Structural beams may be used effectively in lighting schemes. The poured concrete ceiling, with its concrete beams, provides the necessary shielding for lights placed parallel with the beams. In single story schools with wooden ceilings and wooden beams, the beams themselves might be used to provide the necessary baffles. Some steel beams may also be used.

The finish of structural components is one of the applied factors which influence lighting in schools. Matt finishes of wall and ceiling surfaces are most desirable, for this will diffuse spots of light and reduce brightness contrasts. (Matt surfaces will not collect dirt faster than glossy finishes.) The ceiling should be so finished that it reflects at least 80 per cent. of the light which strikes it; higher values are desirable. White is the most desirable, for its percentage of light reflected is 88. The larger and more widespread the lighting area, the softer and less pronounced will be the shadows. Psychologically, colour is important. Draperies, shades, and diffusers are also easily applied light controls.

One important part of any school lighting system seems far beyond the architect's realm and beyond that of the illuminating engineers. We wonder who should control or who could control the important factor of maintenance. Most fixtures collect dust. Some collect paper wads, chalk and other extraneous material. We can devise luminaires that keep the necessity of maintenance at a minimum, but housekeeping is essential, especially school housekeeping.

While the architect and the illuminating engineer must work closely together on proper choice and installation for the best light sources and luminaires, the architect cannot possibly apply all that the illuminating engineer knows. No one building could cope with all of the possibilities. Compromise is inevitable. The only way to procure proper balance is to study the complete bill of fare. This means that the architect will have to study some of the problems of the illuminating engineer, and the illuminating engineer will have to study with the architect. Modifications, compromises and adjustments are often the only ways in which a right answer may be found.

Courses In Illuminating Engineering

It is reported by Mr. K. R. Mackley, hon. secretary of the Liverpool Centre of the I.E.S. that arrangements have now been made for a local course to cover the Intermediate examination of the City and Guilds of London Institute in Illuminating Engineering. The course, which will be an evening one, will be held at the Bootle Technical College, Balliol-road, Bootle, Liverpool. Full details of the course may be obtained from Mr. J. Cormack, B.Sc., M.I.E.E., principal of the college, or from Mr. K. R. Mackley, Inner Temple, 24, Dale-street, Liverpool, 2.

Lighting Problems in a Sugar Refinery

Summary of a lecture given by Mr. F. W. White to the Liverpool Centre of the I.E.S. on March 9th

To an illuminating engineer entering a sugar refinery for the first time the reflecting surfaces of the crystals of the refined sugar may appear to be an excellent medium upon which to apply the most modern ideas on lighting. It would be simple if all the sugar handled was of this kind, but as it changes from a sticky brown mass upon entering the refinery to the clear white crystals as seen in the domestic sugar basin, the lighting engineer's problem is not as simple as it might appear. As sugar is a food product great care must be taken to ensure that it is kept clean and pure, and good lighting is essential to make inspection easy during the various stages of refining.

One of the most difficult problems that has to be overcome is the prevention of the entry of glass into the sugar. Due to the fact that powdered glass and sugar crystals are very similar in appearance, it is a serious matter, and a costly one to rectify, if the two materials should become mixed. Over a number of years this problem has been approached from many angles and with the introduction of any new form of lighting it has been necessary to redesign the protective medium that has to be fitted to the lighting units.

Lighting installations in the early days of sugar refining consisted of the standard type of well glass fitting. The glass shade was robust enough and very little trouble from breakages was experienced. The size of the well glasses reduced the maximum size of lamp that could be used to 100 watts but even with these, due to the transfer of heat from the lamp to the glass, caramelling of the sugar dust on the outside of the glass took place. The fittings were kept clear of the sugar under process in case of accidental breakage but where a reasonably good level of illumination was required a large number of fittings had to be used, and often at low mounting height which resulted in dark ceilings and unpleasant contrasts.

An early improvement was the introduction of a prismatic fitting which had lenses of very thick glass and stood up to a good deal of abuse. The main disadvantage was the narrow angle of spread which necessitated the use of large numbers of such fittings if good illumination was to be obtained. In an attempt to improve the spread of light and to improve the general upward illumination a special lantern was constructed which gave more light in the upwards direction but still left the lower levels in an unsatisfactory condition.

About this time the plastic known as "Perspex" was first introduced and experiments were carried out using this instead of glass in the lighting fittings. It was soon discovered, however, that "Perspex" was electro-static and could be quite easily charged to a high voltage if rubbed with a dry cloth. This had the disadvantage of attracting sugar dust, which is also electro-static, to its surface reducing the light output. The only satisfactory way of overcoming this was to clean the surface of the "Perspex" with a damp cloth and allow it to dry naturally. It was also found that "Perspex" crystallised at temperatures in the region of 265 deg. F. and fittings had to be made with clearances between the lamp and the plastic of not less than 2 in. when used with a 60-watt lamp in an enclosed fitting. With the improvement in the manufacture of "Perspex," moulded lenses were produced and used in the special fittings with excellent results.

Now, with the introduction of the fluorescent lamp the problem of broken glass is once more to the fore. Fittings having "Perspex" channel covers have been tried out but as they are not dust-tight sugar dust can enter the channelling, coat up the surface, and so reduce the light output. With the fluorescent lamp, however, the temperature difficulty is removed and the answer to the breakage problem would appear to be the use of a clear "Perspex" tube which, when slipped over the lamp and fitted with suitable dust-tight rubber seatings at either end, would give a perfectly safe fitting that could be used in any process where broken glass is a danger to the product under manufacture. With a fitting of this type a great many of the lighting problems in sugar refineries, especially in confined spaces, could be easily and effectively solved.

Lighting and the Designer

By RAYMOND PYE

The following article deals with the design of industrial lighting equipment and describes one method of design which has been applied to lighting installations in the textile industry.

I have been invited to give some account of the work on which I am engaged and the relationship between the designer, the manufacturer and the user with particular reference to the problem of lighting.

In industry the designer is at last beginning to make his influence felt and to take his rightful place amongst technicians responsible for producing domestic and industrial equipment. For many years the quality and reliability of British goods have been sufficiently high to overcome a standard of design correspondingly low in comparison with that of other countries. Scandinavia and Switzerland, for example, have for many years rated the designer highly in the technical sphere, and as a result their products have reached a now universally acknowledged level of excellence.

The seller's market is passing and Britain must, in order to survive, produce goods which are of first-rate quality in design as well as materials and workmanship. True design in industry is not the imposition of preconceived shapes and trimmings upon a piece of mechanical equipment in order that it may appear "streamlined" or "styled," but the integration of function, form and colour in order to produce elegance and grace combined with operational simplicity. In order to do this the designer must acquire a thorough knowledge of his materials, manufacturing technique and consumer requirements. Such a study will produce what is known as the design programme, and I cannot emphasise too strongly the vital importance of the closest co-operation between all concerned at this stage. Failure to do so can easily cause difficulties, delays and misunderstandings which may well prejudice the outcome of the whole development.

In some quarters the designer has been regarded as suspect and an influence to be avoided rather than sought. It has even been thought that a designed article would cost more to produce and would not appeal to the public. This attitude is, fortunately, passing with the recognition of the better and more responsible designer, but the fact that it may have a basis of truth should be taken as a warning. The customer is not always right, but it is equally foolish to assume that he is always wrong.

In the design of industrial lighting

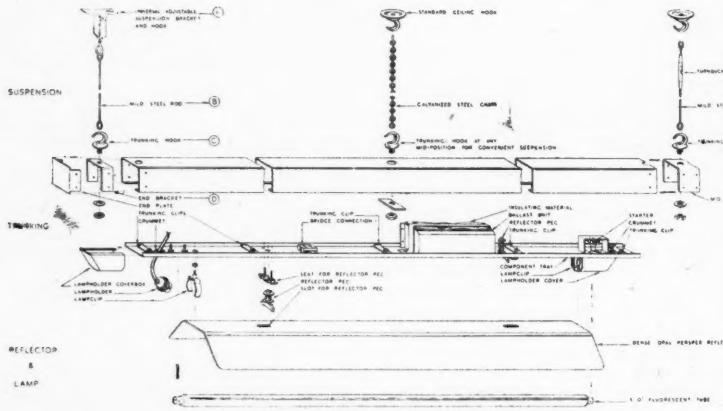


Fig. 1.

the consumer requirements are particularly important and must be given serious consideration as the needs, ideas and sometimes the whims of the customer are usually based upon long experience and intimate knowledge of the manufacturing process to be lighted. It does, of course, happen occasionally that the client may insist upon ideas which are fundamentally unsound, and in such cases the designer must be able to dissuade or reject without in any way endangering or compromising his own position. For this reason it is essential that he should appear as an independent consultant and not as a salaried member of the firm for which he is acting. In this way he is not financially interested in the choice of particular components and is free to give unbiased and disinterested advice.

As an instance of special methods, the design of fluorescent lighting equipment for the textile industry, with which I have been closely concerned, may be cited.

The Arcon System has been devised to meet the need for a more flexible installation and distribution of fluorescent lamps in factories. Hitherto it has been necessary to install lamps in individual fittings requiring the use of long conduit and cable runs, or the use of a continuous trough reflector system, lamps located end to end.

This new system enables the lighting engineer to design a layout giving complete latitude on the number of lines of trunking, and the number of lamps per line. In addition to this, if at any time the plant layout is altered, the position of the lighting units can be easily adjusted, and is based on the use of 20 S.W.G. metal trunking with removable capping, in which all control gear and conductors can be housed. Lamp-holders, lamps, and reflector units are clipped to the underside of the trunking in any required position.

The system comprises lengths of steel or aluminium box sections up to 15-ft. It is finished in a white stove enamelled or sprayed gloss paint and is designed to incorporate any of the standard 4 - ft. and 5 - ft. fluorescent lamps and control gear. All conductors are carried within the trunking on suitable stirrups. It has been found that erection of the trunking can be effected at the rate of 50 ft. per hour. The choice of reflectors lies between metal or "Perspex," the latter giving slightly less concentration on account of a percentage of the light passing upwards through the translucent material.

The arrangement enables an illu-

Fig. 2.

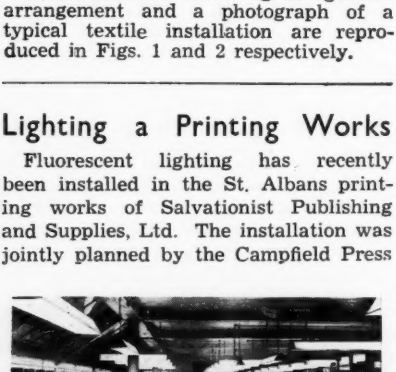
mination at the working surface up to 50 lumens per sq. ft. to be provided, and it can be rapidly installed with a minimum interference with current production. It enables all components to be readily accessible for maintenance; and, requiring suspension at less frequent intervals than ordinary fluorescent fittings, it is less bulky in appearance. The overall cost naturally depends on the spacing of the lights but is usually of the order of £10 a point.

The system was designed primarily to meet the needs of the textile industry and has been successfully installed in a number of mills in the Huddersfield area. It is hoped that it will prove practical and economic in other industries.

A detailed view showing the general arrangement and a photograph of a typical textile installation are reproduced in Figs. 1 and 2 respectively.

Lighting a Printing Works

Fluorescent lighting has recently been installed in the St. Albans printing works of Salvationist Publishing and Supplies, Ltd. The installation was jointly planned by the Campfield Press



management and Engineering and Lighting Equipment Co., Ltd., of St. Albans, by whom the lamps and control gear were furnished and the fittings made.

So far a total of 323 80-watt and 78 40-watt fittings are in use. The picture gives a good idea of the effect, the opal "perspex" side panels helping greatly to prevent any possible "tunnel effect," and we understand that the installation has given great satisfaction.

Glasses and Glassware

Experiences during the past ten years have led to considerable expansion in the variety of products of some firms in the glass industry. An instance is afforded by Chance Brothers, Ltd., whose display at the B.I.F. included not only the optical glass and laboratory glassware for which they are famous but lighting glassware and table glassware as well. It is interesting to recall that 1948 is the centenary in Great Britain of the manufacture of optical glass, introduced by Robert Lucas Chance in 1848. Amongst the specialities on view were colour filter glass (of which over 40 shades are available), ophthalmic and eye-protecting glasses, and laboratory glassware ("Hysil") with a very low coefficient of expansion.

Lighting Up the Clock

The Royal Liver Building Clock, famous 36-year-old landmark of Liverpool, is now showing once again, after eight years of blackout. For this the architects of the building, Messrs. Briggs, Thornley, and McLaughlin, in co-operation with Philips Electrical, Ltd., were responsible. Six 140-watt sodium lamps have been installed symmetrically around each of the four faces with opal screens to ensure good diffusion. Now the faces of the clock can be seen from afar—from Wallasey, Birkenhead, the west side of the river, and many parts of Liverpool. This is said to be the largest electric clock in England. Each of the four dials is 25 ft. in diameter, which is 2½ ft. wider than Big Ben.

Lighting in Saudi-Arabia

Electric lighting in Taif, a town in Saudi-Arabia, is to replace the present primitive arrangements largely with oil lamps. The Brush Company has been granted a contract for the supply of power station and distribution equipment and the supply will be undertaken by the Saudi Electric Supply Company, of Mecca. The initial capacity of the power station will be 1,200 kw. Distribution will be at 3,300 volts, stepped down at transformer stations to 415/240 volts for consumers.

Colour Terminology

Discussion on the recently published report by the Colour Group of the Physical Society.

There was a lively discussion when the Colour Group's Committee responsible for the "Report on Colour Terminology"* presented the Report at a meeting of the Group, held on Wednesday, April 28, at the rooms of the Royal Photographic Society. Mr. J. G. Holmes (Chairman of the Group), Dr. R. K. Schofield, Mr. G. T. Winch, Dr. V. G. W. Harrison, Mr. R. G. Horner, and Dr. W. D. Wright each gave a brief exposition of a particular aspect of the Report.

It was explained that the aim was to list and define the terms, relating to colour, which are used in colour physics and the study of colour vision, in various industries such as dyeing, printing, and decorating, in the painting art and in everyday life. It had proved possible to co-ordinate the terms used by the various interests and to recommend a consistent terminology which involved surprisingly few major changes in present practice. The most important of these was the abandonment of the term *brightness* in the two senses used by photometrists and illuminating engineers, and the substitution of *luminance* and *luminosity*. Luminance was to be used when brightness as a stimulus magnitude was intended (e.g., we should say the sun's *luminance* is 165,000 candles per sq. cm.). On the other hand, when the intensity of luminous sensation was in question we should speak of *luminosity* (e.g., we should say the luminosity of a surface of fixed luminance depends on the luminance of the surrounding field). The principal concession asked of industry was the introduction of the term *hue*, with its colour physics meaning as the attribute of visual sensation by which the different parts of the spectrum are distinguished. At present, *shade* and *dominant hue* are used.

An analysis by Mr. Horner of the answers to a number of questions on colour terminology, given by visitors to the Physical Society's recent exhibition, brought out several interesting points, including the widespread use of the term *shade* to describe colour differences.

Dr. Wright discussed the Report in relation to the negotiations in progress between colorimetrists of the American and British National Committees in preparation for the I.C.I. meeting, to be held shortly in Paris. The American and British definitions of *light* and *colour* differed in several respects which was unfortunate but unlikely to lead to difficulty. On most other terms it seemed probable that American and British views would coincide. The American use of X, Y, Z as symbols for the actual quantities of the three reference stimuli in a match, and not merely as names identifying the reference stimuli, was strongly criticised by Dr. Wright.

In the discussion, Dr. Schofield defended the American use of X, Y, Z, and was prepared to admit that in appropriate cases Y might stand for reflection factor. On a show of hands, the meeting expressed a slight preference for keeping X, Y, Z exclusively as qualitative symbols for the reference stimuli. A term in the Report which attracted some criticism was *visual sensitivity*, defined as the ratio of luminous flux to radiant energy flux. It was argued that *visual sensitivity* was too wide a term to appropriate for the special meaning ascribed to it. Dr. MacLatchy believed that to ophthalmologists it would suggest concepts quite different from that intended. The difficulty was that *luminosity factor*, the present I.C.I. term, could not be retained if the new subjective definition of *luminosity* were adopted. Dr. Wright explained that *visual sensitivity* was the term which the Committee felt was the least satisfactory of those they had proposed, and he thought that some other alternative would have to be found.

While no great enthusiasm was shown for the introduction of *luminance* in place of brightness (stimulus sense), the possibility that *photometric brightness* might be retained as an equally valid alternative, probably had a mollifying effect on some critics.

The labours of the Committee in preparing a most valuable report were warmly acknowledged by the meeting.

*The Physical Society, 1, Lowther Gardens, Prince Consort Road, London, S.W.7. Price to non members 7s. net, including postage.

I.E.S. Cinema Studio Visit

A party of 20 members of the Illuminating Engineering Society spent a full day on April 27, when they visited the Pinewood Studio, on Iver Heath. All the five large stages were in use, and the party were able to see many parts of the process of shooting films.

The party went over the workshops, including the plaster shop and the Special Effects section, where there were demonstrations of the new back-projection process for scenery, now being installed on a large scale, and of the "matte" process in which small-scale coloured backgrounds are worked into the scene to provide effects which would not be practicable on the stage.

The lighting arrangements naturally received special notice. On the stages the lighting arrangements largely followed the lines described by Mr. F. V. Hauser in a recent paper before the Society, "Photographic Illumination in Motion Picture Studios," with examples of "bashers," "snoots," and "barn-doors." The lighting in the make-up rooms, hairdressing rooms, and the special effects section consisted of filament lamps throughout, although arc light was in general use on the stages, and daylight for outside sets, and this arrangement was found satisfactory even for colour films.

The visit was arranged by Mr. H. G. Coward, the studio manager, and the party were conducted around the studio by Mr. F. Capon. All the members of the party left with the firm intention of seeing the films "Passionate Friends" and "Blue Lagoon," which they had seen during shooting on the stages.

On the same day a further party of 12 I.E.S. members visited the London Film Studios, at Shepperton, which was arranged by Mr. Charles Hillyer, the studio manager.

"Darkness into Daylight"

An exhibition of the above title was opened at the Science Museum, South Kensington, on April 29, to mark 100 years of research and achievement in electric lighting. The exhibition, which will be open until September, is attractively laid out and contains a number of working demonstrations which will appeal to the lighting engineer and the general public alike.

The exhibits are arranged to show progress through the ages, the first two sections showing early oil lamps, gas lamps, and the development of the first electric lamps to give sufficient light for practical use. Another section shows progress that was made over the same period in lighting fittings.

One section is devoted to the development of the electric filament lamp, beginning with Swan's original carbon filament lamp and shows the many applications to which this type of light source has been put. Other light sources on view are the metallic vapour discharge lamps, the compact source lamps used for film studio lighting, and the new xenon arc, which has recently been developed by Dr. J. N. Aldington.

The range of fluorescent lamps of the hot and cold cathode types are also shown, with many instances of their applications in various fields of lighting. Some emphasis is given to the colour-rendering properties of light sources, and the exhibition has been planned throughout so that technical details will be understood by the ordinary person.

Of particular interest to women is the living room of the future, which shows the possibilities of the application of lighting to the architecture of the home.

The National Physical Laboratory

The National Physical Laboratory at Teddington is holding, from 2.30 to 6 p.m. on Monday, June 21, an Open Day, to which representatives of industrial organisations are being invited.

The wide range of scientific research and investigational work undertaken at this establishment is already well known to industry, but there may still be a large number of firms with whom the N.P.L. has no contact. Some of these will undoubtedly wish to take this opportunity of seeing the scope of the Laboratory's activities, and a number of invitations is being reserved for this purpose.

Accredited representatives of industrial organisations interested in the work of the Laboratory are invited to apply to the Director, National Physical Laboratory, Teddington, Middlesex, not later than Saturday, June 5.

The EDITOR Replies

I learn with interest that *Mr. R. Marted.* whose long association with the B.T.H. Research Laboratories is well known to I.E.S. members, has now left this country to take up an appointment in *New Zealand.* All his many friends will join in wishing him every success in his new work.

A communication from Mr. Percy Waldram bearing on the recent I.E.S. informal discussion on *Natural and Artificial Light* has been passed on to me for attention. It will be recalled that no formal record of this meeting was taken though a brief summary appeared in our last issue (April, 1948, pp. 74-75).

Mr. Waldram makes the interesting suggestion that artificial lighting may be detrimental to health by the very excellence which illuminating engineers strive so hard to attain! The *human eye,* he points out, has developed under the constant necessity of *adapting itself unconsciously to the huge variations in daylight.* Visual health, therefore, suffers when it is deprived of this exercise—in much the same way that the health of the body suffers when deprived by perfect ventilation indoors from the exercise of adapting itself to the changes of outdoor temperature and air movement. He cites in this connection the evidence of an eminent medical authority that in the *windowless factories in America* the *afternoon somnolence of workers*—under the most perfect conditions of light and air—has become quite a serious problem.

This is certainly a novel suggestion, which deserves consideration—though I imagine that Mr. Waldram would hardly suggest that we should seek to imitate, in artificial illumination, the enormous fluctuations of daylight (which from the technical standpoint have always been regarded as its greatest drawback). I fancy, too, that not everyone would support the belief that constant changes in temperature are beneficial. (During the severe 1946-47 winter I had the opportunity of enlarging to an American visitor on the benefits of the free circulation of air and changes of temperature met with in the average British home as compared with the even, high temperature maintained in American homes by central heating. He was quite unconvinced.)

It seems a pity that we have so little detailed and authoritative evidence on what is surely the most important aspect of daylight, its *influence on health.* One can hardly doubt that people whose occupation deprives them of a fair share of daylight—miners for example—are prone to fall victim to diseases which they might otherwise escape. The rapid inroad of tuberculosis in Greenland has been attributed to the fact that the Eskimos spend several winter months in complete darkness. Yet it might, I suppose, be argued that the same disease developed rapidly in Polynesia,

where conditions of natural lighting are quite different.

I have heard some further discussion on the vexed question of the effect of fluorescent lighting on colours and appearance of objects. Many people agree that faces do not look at their best under this system—as one may verify when descending an escalator lighted in this fashion. Perhaps it is not only the colour that is responsible. In his recent series of articles in this journal, Mr. A. W. Jervis seems to suggest that harshness of shadows may be partially responsible.

I observe, however, that elsewhere he stresses the need for a tube *intermediate in colour* between the "daylight" and the "warm white," and I have heard others express the same view. It is noteworthy, however, that natural appearance of colours is not always the main consideration in choosing an illuminant. The warm white seems to be usually preferred for shops, indeed sometimes even by florists who find that the colours of flowers, if not so "true," are nevertheless more attractive!

The problem *how best to allocate the reduced street lighting* sanctioned by the authorities is likely to become more acute with a return to winter conditions, but even at present one notes cases in which the expediency of concentrating on the lighting of main roads is questioned. Thus, Mrs. A. H. S. Hendries, a member of the Southwark Council, stressed the condition of back streets round the Elephant and Castle, stated after midnight to be "as dark as during the blackout." The Works Committee, however, turned down the suggestion of better lighting for these side streets, contending that adequate lighting of main arteries of traffic was more important.

SITUATIONS VACANT

ILLUMINATING ENGINEER (25-35 years). Must be conversant with modern lighting practice and be able to plan complete schemes for industrial and exterior lighting. Applications, giving full particulars of experience, qualifications, age, and salary desired, should be addressed to the Staff Manager, Siemens Electric Lamps and Supplies, Ltd., 38-9, Upper Thames-street, London, E.C.4.

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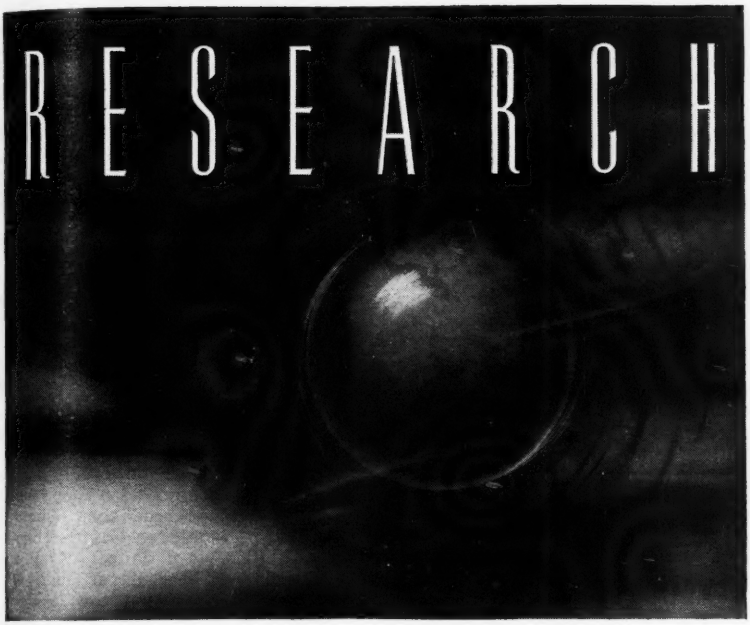
ILLUMINATING ENGINEER required for Technical Advisory Service organisation of Manufacturing firm in Midlands. Corporate Membership of I.E.E. desirable, organising ability and previous experience on similar work essential.—Box No. 777, "Light and Lighting," 32, Victoria-street, London, S.W.1.

Personal Notes

Mr. W. E. Ballard, late of the General Electric Co., Ltd., in Manchester, has joined the staff of Concrete Utilities, Ltd. He is acting as northern area sales manager and illuminating engineer, operating from their Kirkby (near Liverpool) works and branch office.

Mr. Ballard is a Fellow of the I.E.S. and is secretary of its Manchester Centre. He served for six years in the R.A.F., when he became a squadron leader in Bomber Command.

Mr. Horace A. Deacon, who has been holding the position of sales manager and, more recently, general manager of Cryselco, Ltd., has now been appointed managing director. His many friends in the lighting industry will learn with interest of this development.



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Practical Management and Works Relations

The following is an abstract of an article by A. C. Whitehead, which appeared in "Mechanical World," March 26, 1948

In a series of articles, of which the one from which this abstract is taken is the first, the author sets out to show how greatly increased output per man-hour can be developed by methods which have been practised successfully over a wide range of work. In a factory or workshop employees prove their skill and good will by the quantity and quality of the work they do under the conditions provided by their employers. To some extent both quality and quantity may be raised by improving conditions and facilities, though it is not always possible to disentangle the effect of several changes acting concurrently, and in a few cases these effects may not be noticeable for some time. Hence, although an employer may seek to provide the best possible conditions there is some doubt as to the amount which may justifiably be spent on such improvements.

In regard to lighting the author points out that though insufficient light causes sluggishness, adequate light wrongly directed may cause discomfort and fatigue. The eye cannot adapt itself to suit both bright and dim light at the same time and the change from one to the other takes an appreciable time. A more general understanding of the principles of good lighting is most important and the author describes two simple experiments to illustrate the desirability of soft shadows as an aid to visibility and to show the bad effect of violent contrasts.

The first experiment needs three persons, A, B, C, a small torch, a dark night, and a field away from street lamps or windows and where there are no bushes, trees, or anything to give side reflection. A is the observer, B controls the torch. Preferably C should wear a dark coat. A and C face each other a few yards apart. B circles round with a narrowly focused beam directed on C's face. When B is close to A the outline of the face is plain, and the eyes, brows, and mouth clearly seen because they are darker than the skin. But there are no shadows to indicate prominences or depressions. When B moves to one side so that B C A is a right-angle, the shadows are too intense for one side of C's face to be distinguished. When B C A is a straight line A can see an outline, but with difficulty unless the torch is eclipsed by C's head. Next repeat the experiment close to a wall and observe how the light reflected from it improves visibility. Observe how necessary graded shadows are to reveal depth.

The second experiment involves an observer reading a book and facing a light source. When the source is visible to the side of the book the type becomes more difficult to read than when the light source is hidden. If the book is lowered there is a danger of specular reflection from the paper but if the observer turns so that the light falls sideways on to the book he can read in comfort.

Observation of places where people are at work will show to what extent reasonably satisfactory use is made of existing sources of light. There are to be found typists facing windows through which daylight glares while the fronts of their machines are in shadow. Watch mechanics place portable lights where they can dazzle most effectively. And draughtsmen often seem anxious to ruin their eyes by the blinding reflection they contrive to get from white drawing paper. On the whole the present artificial lighting of workshops compares unfavourably with that common to retail shops and stores.

The author concludes this section on lighting with the advice that as there are so many factors to be considered in the design of a lighting scheme professional advice is necessary to ensure satisfactory results.

Reference is made to the I.E.S. Code for the Lighting of Building Interiors which, it is stated, contains in condensed form a mass of useful advice and data.

Reviews of Books and Publications Received

Electric Discharge Lighting. By F. G. Spreadbury. (*Sir Isaac Pitman and Sons, Ltd., London,* 1946; *pp.* 136, *figs.* 122. *Price* 15*s. net.*)

The author deals primarily with electric discharge *lamps*—rather than "lighting," as little is said in regard to illumination. Chapter I deals with the phenomena underlying luminous electric discharges. The three subsequent chapters are devoted in turn to low-pressure cold-cathode, high-pressure mercury and sodium vapour and fluorescent lamps. They thus present a picture of developments from the era of the Moore tube and other sources utilising luminescent rare gases up to the familiar fluorescent lamps of to-day. The operating characteristics of these lamps and their accessories are discussed in considerable detail, and such matters as stroboscopic effect and the influence of variation in supply voltage are touched upon. The two final chapters contain a mathematical treatment of discharge-lamp circuits, and an analysis of the theory and design of chokes and transformers. The book is well printed and aided by a generous allowance of illustrations, and there is an adequate index.

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Shadow and Diffusion in Illuminating Engineering

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Konrad Norden, Ph.D., F.I.E.S.

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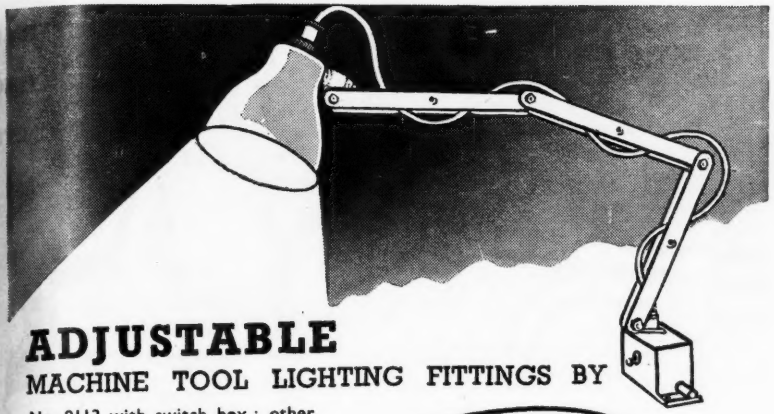

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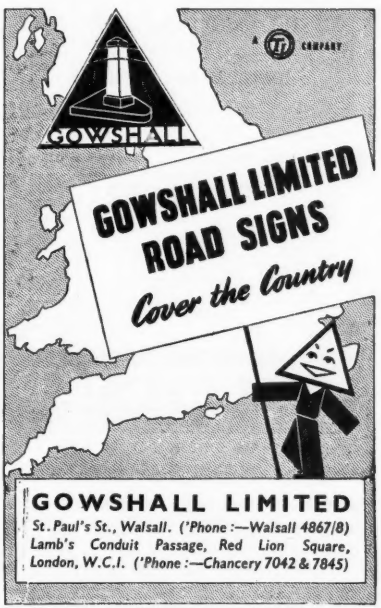

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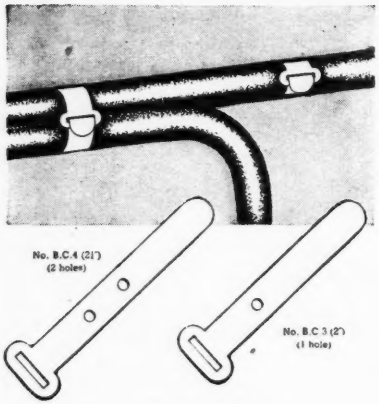

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to 15/6 (Purchase Tax 4/-)

★ **4ft. 40 w. from 16/6 (Purchase Tax 4/4)**
to 14/- (Purchase Tax 3/8)

These figures apply to both daylight and warm-white lamps.

July 1st, 1948

NEW LAMPS. The Electric Lamp Manufacturers' Association recently announced the marketing of two new sizes of fluorescent lamps on July 1st, 1948. The list price of the 2ft. 40w. lamp was to have been 14/-, it will now, however, be listed at 13/- (Purchase Tax 3/5).

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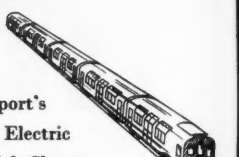

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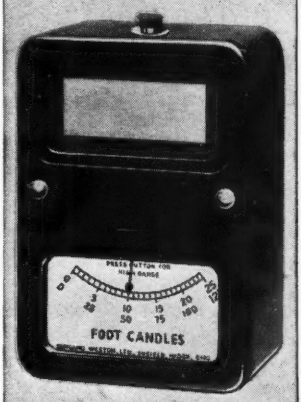

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